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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/516,311	08/12/2005	Tadahiro Ishizaka	263194US3PCT	3893

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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
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EXAMINER	
CHANDRA, SATISH	
ART UNIT	**PAPER NUMBER**
1792	

NOTIFICATION DATE	DELIVERY MODE
12/03/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/516,311	ISHIZAKA ET AL.	
	Examiner	Art Unit	
	Satish Chandra	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 0207*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *9,10,12 - 18, 21, 22, 24 - 28 and 30 - 37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *9,10,12 - 18, 21, 22, 24 - 28 and 30 - 37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 December 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/05,12/06,7/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/17/207 has been entered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 9, 10, 12, 13, 17- 18, 22 and 25 are rejected under 35 U.S.C. 102(a) as being anticipated by Shirakawa et al (US 6,380,518).

Shirakawa et al discloses:

Regarding claims 9, 17, 18 and 25, a processing apparatus, comprising a chamber (not labeled, having a cross-section of triangular shape as seen from the direction perpendicular to the bottom wall, not shown), Figs 14, 15, 17, 18, 25, Column 13, lines 10 – 15 and 49 – 60)); a gas supply section 110, 115, 120 provided to said chamber having a plurality of gas supply holes arranged approximately parallel with the direction of width of the processing chamber and for supplying a predetermined gas (air)

into said chamber; the air board 113 regulates the air stream into virtually an equilateral triangular gas flowing region 99 above the hot plate 58 wherein the air board 113 is formed of a long and narrow rectangular board and exhaust openings 123, 124 and 125 provided to said chamber so as to face said gas supply section 120, 110 and 115, connected to exhaust means (not shown) for exhausting an interior of said chamber, wherein said chamber has a gas flow passage extending from said gas supply opening (for example 110) to said exhaust opening (for example 124), and wherein said gas flow passage has a transverse cross-sectional area with at least a width that decreases in inverse proportion to a distance from said gas supply opening along said gas flow passage. The processing apparatus further comprises an exhaust blower (not shown) and either a plant intensive exhaust unit (not shown) communicating with the gas supply system (Column 9, lines 66 – 67, Column 10, lines 1- 3).

The apparatus of Shirakawa et al is capable of performing an ALD process and ALD is the intended use of the apparatus.

Regarding claim 10, gas supply openings 134, 135 and 136 (Fig 18) are connected to gas supply means (not shown).

Regarding claim 12, since the air (gas) flows smoothly in the gas flowing region 99, neither spiral nor stagnant streams occur (Column 18, lines 14 – 18). It is therefore inherent that the thickness of a boundary layer is approximately constant, said boundary layer being formed when said gases are supplied into said chamber, on a wall of said chamber that extends along a direction of flow of said gases.

Regarding claim 13, since the air (gas) flows smoothly in the gas flowing region 99, neither spiral nor stagnant streams occur (Column 18, lines 14 – 18). It is inherent that the thickness of a boundary layer is approximately constant, said boundary layer being formed when said gases are supplied into said chamber, on a substrate placed in said chamber approximately parallel with a direction of flow of said gases.

Regarding claim 22, the height of the transverse cross-sectional area remains constant along said gas flow passage.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 14, 24 and 25 – 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shirakawa et al (US 6,380,518) in view of Eversteijn et al (US 3,750,620).

Shirakawa et al were discussed above **but do not disclose:**

Regarding claims 14 and 24, a chamber having a bottom wall configured to support the substrate.

Regarding claims 25 - 27, said exhaust opening 185 (Fig 25) is provided on said chamber at a location on a vertex portion of the approximately triangular shaped cross-section of said chamber; said gas supply opening 183 is provided on said

chamber at a location on a side of the approximately triangular shaped cross-section of said chamber that is opposite to said vertex portion; and said gas supply opening extends along substantially an entire length of the side of the approximately triangular shaped cross-section of said chamber that is opposite to said vertex portion.

Eversteijn et al disclose:

Regarding claims 14 and 24, a reactor 1 (Fig 1) having a bottom wall configured to support the substrate,

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a bottom wall in a reaction chamber to support a substrate in the apparatus of Shirakawa et al as taught by Eversteinj et al.

The motivation for providing a bottom wall in the apparatus of Shirakawa et al is for support a substrate as taught by Eversteijn et al.

Claims 15, 16, 28, 30, 31, 36 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al (US 2003/0070617) in view of Shirakawa et al (US 6,380,518).

Kim et al disclose:

Regarding claims 15, 28, 36 and 37, an atomic layer deposition apparatus and method comprising a vacuum chamber (abstract) by supplying first reactive gas (NH3 or H2) and a second reactive gas (TiCl4) (fig 2, Para 0030) into a vacuum chamber 4 to form a thin film of TiN (Para 0043) by alternately supplying each of the two gases wherein the height of the transverse cross-sectional area remains constant along the gas flow passage (Fig 1).

Regarding claim 30, process chamber has a bottom surface supporting the substrate.

Kim et al do not disclose:

Regarding claim 15, a process chamber having a transverse cross-sectional area with at least a width that decreases in inverse proportion to a distance from said gas supply opening.

Regarding claim 16, a boundary layer having an approximately constant thickness is formed on a wall of the process chamber and said substrate along a direction of flow of the said gas.

Regarding claims 30 and 31, the process chamber has a cross-section that has an approximately triangular shape as seen from a direction approximately perpendicular to the bottom wall and the process chamber has an exhaust opening that is provided on a vertex portion of the approximately triangular shaped cross-section of the process chamber and the gas supply opening that extends along substrantially an entire length of the side of the triangular shaped cross section is provided that is opposite to the vertex portion.

Shirakawa et al were discussed above and disclose:

. **Regarding claims 15, 30 and 31,** a processing apparatus, comprising a chamber (not labeled, having a cross-section of triangular shape as seen from the direction perpendicular to the bottom wall, not shown), Figs 14, 15, 17, 18, 25, Column 13, lines 10 – 15 and 49 – 60)); a gas supply section 110, 115, 120 provided to said chamber having a plurality of gas supply holes arranged approximately parallel with the

direction of width of the processing chamber and for supplying a predetermined gas (air) into said chamber; the air board 113 regulates the air stream into virtually an equilateral triangular gas flowing region 99 above the hot plate 58 wherein the air board 113 is formed of a long and narrow rectangular board and exhaust openings 123, 124 and 125 provided to said chamber so as to face said gas supply section 120, 110 and 115, connected to exhaust means (not shown) for exhausting an interior of said chamber, wherein said chamber has a gas flow passage extending from said gas supply opening (for example 110) to said exhaust opening (for example 124), and wherein said gas flow passage has a transverse cross-sectional area with at least a width that decreases in inverse proportion to a distance from said gas supply opening along said gas flow passage.

Regarding claim 16, since the air (gas) flows smoothly in the gas flowing region 99, neither spiral nor stagnant streams occur (Column 18, lines 14 – 18). It is therefore inherent that the thickness of a boundary layer is approximately constant, said boundary layer being formed when said gases are supplied into said chamber, on a wall of said chamber that extends along a direction of flow of said gases.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a process chamber having a transverse cross-sectional area with at least width that decreases in inverse proportion to a distance from said gas supply opening in the apparatus of Kim et al as taught by Shirakawa et al; process chamber having a cross-section that has an approximately triangular shape as seen from a direction approximately perpendicular to the bottom wall wherein the

exhaust opening is located on a vertex opposite to the gas supply opening in the apparatus of Kim et al as taught by Shirakawa et al.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to smoothly flow the gas in the process chamber so that the thickness of the boundary is approximately constant on the wall of the process chamber in the apparatus of Kim et al as taught by Shirakawa et al.

The motivation for providing a process chamber having a transverse cross-sectional area with at least width that decreases in inverse proportion to a distance from said gas supply opening in the apparatus of Kim et al as taught by Shirakawa et al is to provide an alternate and equivalent process chamber in the apparatus of Kim et al.

The motivation for providing a process chamber having a cross-section that has an approximately triangular shape as seen from a direction approximately perpendicular to the bottom wall wherein the exhaust opening is located on a vertex opposite to the gas supply opening in the apparatus of Kim et al as taught by Shirakawa et al is to optimize the process chamber for uniform gas flow in the apparatus of Kim et al.

The motivation for smoothly flowing the gas in the process chamber so that the thickness of the boundary is approximately constant on the wall of the process chamber in the apparatus of Kim et al as taught by Shirakawa et al is to form a layer of film of desired thickness on the substrate in apparatus of Kim et al.

Claims 32 - 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shirakawa et al (US 6,380,518) in view of Kim et al (US 2003/0070617).

Shirakawa et al were discussed above and do not disclose:

Regarding claims 32 – 35, the film to be formed is TiN from plural species of gases of TiCl4 and NH3 alternately supplied.

Kim et al disclose: an atomic layer deposition apparatus and method comprising a vacuum chamber (abstract) by supplying first reactive gas (NH3 or H2) and a second reactive gas (TiCl4) (fig 2, Para 0030) into a vacuum chamber 4 to form a thin film of TiN (Para 0043) by alternately supplying each of the two gases.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to supply first reactive gas NH3 and a second reactive gas TiCl4 into a process chamber to form a thin film of TiN by alternately supplying each of the two gases in the apparatus of Shirakawa et al.

The motivation for supplying first reactive gas NH3 and a second reactive gas TiCl4 into a process chamber in the apparatus of Shirakawa et al is to form a thin film of TiN on the substrate by alternately supplying each of the two gases.

Response to Arguments

Applicant's arguments filed 10/17/2007 have been fully considered but they are not persuasive.

Regarding the arguments:

Regarding the rejection of Claim 9 under 35 U.S.C. § 102(a), the '518 patent is directed to a heat treatment apparatus and substrate processing system. In particular, the '518 patent discloses providing a small heat treatment apparatus capable of heating a substrate uniformly, while preventing particles from being attached to the substrate.2 The '518 patent discloses that a wafer coated with photoresist is placed into a chamber, and that when a temperature detected by a sensor 97 is beyond an acceptable range, the power supply to a heat 96 is controlled or a flow amount and rate of the air (gas) sent from the pipe 64 toward the hotplate 58 are controlled. The '518 patent discloses that subsequently, operations of the gas supply system 91 and the exhaust system 92 are individually initiated thereby forming gaseous streams from the first lateral wall 52

toward the second lateral wall 52b.3 Further, the '518 patent discloses that even if particles are contained in gaseous streams flowing through an upper treatment space 59, neither speed loss nor stagnation of gaseous streams occurs. Thus, the '518 patent discloses that it follows that particles will not fall upon the wafer W and thus not adhere to the wafer W in the heat treatment chamber.4

However, it is respectfully submitted that the '518 patent fails to disclose a processing apparatus for forming a film using atomic layer deposition (ALD), comprising: a process chamber, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum. Rather, the '518 patent discloses that air is simultaneously blown out of nozzle holes of a linear pipe and exhausted through an exhaust port, to form gaseous streams above a hotplate.5 Further, the '518 patent is silent as to the use of atomic layer deposition (ALD). The '518 patent does not disclose a processing apparatus for forming a film using atomic layer deposition (ALD), comprising: a process chamber, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum.

The Examiner disagrees because of the following reasons:

The apparatus of Shirakawa is capable of doing an ALD process. The apparatus of Shirakawa like any other processing apparatus is air proof (leak tight) and is exhausted to the vacuum (exhaust blower). It is well known in the art that the exhaust blowers pull inches of water column vacuum in an apparatus.

Regarding the arguments:

Amended Claim 14 is directed to a processing apparatus for processing a substrate using atomic layer deposition (ALD), said processing apparatus comprising: (1) a process chamber having a bottom wall configured to support the substrate, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum; (2) a gas supply opening provided to said process chamber and connected to gas supply means for alternately supplying plural species of gases into said process chamber; and (3) an exhaust opening provided to said process chamber and connected to exhaust means for exhausting the interior of said process chamber, wherein said process chamber has a cross-section that has an approximately triangular shape as seen from a direction approximately perpendicular to said bottom wall. The changes to Claim 14 are supported by the originally filed specification and do not add new matter.6

Regarding the rejection of Claim 14 under 35 U.S.C. § 103(a), as discussed above, the '518 patent fails to disclose a processing apparatus for forming a film using atomic layer deposition (ALD), comprising: a process chamber, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum, as

recited in Claim 9. Thus, the '518 patent does not disclose a processing apparatus for processing a substrate using atomic layer deposition (ALD), said processing apparatus comprising: a process chamber having a bottom wall configured to support the substrate, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum, as recited in Claim 14.

The Examiner again disagrees for the reasons given above. All apparatus must be air-tight (air-proof) or the process won't be performed efficiently. The apparatus of Shirakawa is capable of doing an ALD process and is the intended use of the apparatus.

Regarding the arguments:

Further, it is respectfully submitted that the '620 patent fails to remedy the deficiencies of the '518 patent, as discussed above. The '620 patent is directed to a vapor deposition reactor. In particular, the '620 patent discloses a reactor that is provided with members intended to pass a gas stream in the direction of the arrows 5 through the tube 2.7 However, the '620 patent does not disclose a processing apparatus for processing a substrate using atomic layer deposition (ALD), said processing apparatus comprising: a process chamber having a bottom wall configured to support the substrate, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum.

Thus, no matter how the teachings of the '518 and '620 patents are combined, the combination does not teach or suggest a processing apparatus for processing a substrate using atomic laver deposition (ALD), said processing apparatus comprising: a process chamber having a bottom wall configured to support the substrate, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum.

The Examiner again disagrees for the reasons given above. ALD is the intended use of the apparatus.

Regarding the arguments:

Claim 15, recites in part, a method for processing a substrate placed in a process chamber, an interior of the process chamber being maintained airproof so as to be exhausted to a vacuum, using atomic layer deposition (ALD), by alternately supplying plural species of gases into said process chamber from a gas supplying opening and switching atmosphere in said process chamber. The changes to Claim 15 are supported by the originally filed specification and do not add new matter.8

As noted above, the '518 patent fails to disclose using atomic layer deposition (ALD) and the process chamber recited in Claim 9. Thus, the '518 patent fails to disclose the method of Claim 15. Accordingly, it is respectfully submitted that the rejection of Claim 15 (and all associated dependent claims), under 35 U.S.C. § 102(a), is rendered moot by the present amendment to Claim 15.

Further, the '620 patent fails remedy the deficiencies of the '518 patent, as discussed above. Accordingly, it is respectfully submitted that the rejection of Claim 15 (and all associated dependent claims), under 35 U.S.C. § 103(a), is rendered moot by the present amendment to Claim 15.

Regarding the rejections of dependent Claims 24-27, 30, and 31 under 35 U.S.C. § 103(a), it is respectfully submitted that the '620 patent fails to remedy the deficiencies of the '518 patent, as discussed above. Accordingly, it is respectfully submitted that the rejections of dependent Claims 24-27, 30, and 31 are rendered moot by the present amendment to the independent claims.

Regarding the rejections of dependent Claims 23 and 29, it is respectfully submitted that the rejections of those claims is rendered moot by the present cancellation of Claims 23 and 29.

The present amendment also sets forth new Claims 32-37 for examination on the merits. New Claims 32-37 are supported by the originally filed specification and do not add new matter.9 It is noted that these more detailed features are not disclosed or suggested by the '518 and '620 patents.

Thus, it is respectfully submitted that independent Claims 9, 14, and 15 (and all associated dependent claims) patentably define over any proper combination of the '518 and '620 patents.

A new reference of Kim et al (US 2003/0070617) has been brought which discloses an ALD apparatus and method using the desired gases of NH3 and TiCl4 to form a TiN film on the substrate.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Satish Chandra whose telephone number is 571-272-3769. The examiner can normally be reached on 8 a.m. - 4:30 p.m. If attempts to reach the examiner by telephone are unsuccessful, Primary Examiner, Jeffrie R. Lund, can be

reached on 571-272-1437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Satish Chandra

Jeffrie R. Lund
Primary Examiner

SC, 10/23/2007